

Northeast Coastal and Barrier Network Parks

Assateague Island National Seashore (ASIS)

Assateague encompasses more than 19,000 hectares, more than half of which consists of oceanic and estuarine waters surrounding the Island (Figure 1). Located within a three-hour drive of the Washington/Baltimore/Philadelphia metropolitan area, the National Seashore hosts more than 1.8 million visitors every year. Assateague Island consists of three major public areas. Approximately 26,000 acres of this island are located in Maryland. The state of Maryland manages a section of the northern part of the island called Assateague State Park and the NPS manages the remainder of the Maryland portion of the island as Assateague Island National Seashore. The Virginia section of the island is managed by the U.S. Fish and Wildlife Service as Chincoteague National Wildlife Refuge. The northern 10 km of ASIS called the "north end", is managed as a primitive area where public access is limited to foot and boat-in traffic. Vehicle traffic is restricted to NPS beach patrols and authorized research activities. The 3.2 km section of the island immediately south of Assateague State Park is managed by ASIS as a developed recreational area and includes campgrounds, day-use facilities and interpretive trails. The 19 km section south of the developed area to the MD/VA state line is managed as a primitive and traditional recreation area, which permits off-road vehicle (ORV) use, back-country camping and hunting. Off-road vehicle use is restricted to the ocean beach and other designated trails west of the ocean beach.

The park's natural resources include a diverse assemblage of aquatic and terrestrial wildlife, including the free-roaming feral horses for which Assateague is famous. The vegetation communities, geological features and physical processes reflect the complexity of the land/sea interface along the Mid-Atlantic coast. The indigenous plant communities at ASIS reflect the adaptive extremes necessary for survival on a barrier island, where exposure to salt spray, lack of freshwater, and shifting sands create a harsh and dynamic environment.

Changing patterns in land use within the watershed of the coastal lagoons of ASIS threatens park water quality and biotic systems. Although park waters are considered to be in "good" condition at present, nearby estuaries with more extensive development are significantly degraded, primarily due to nutrient enrichment from anthropogenic nutrient inputs. With a projected growth rate of >20% in land development over the next 25 years, the potential for similar degradation of park waters is considered high. The ability to document changing estuarine conditions, including trends in submerged aquatic vegetation, fish, and benthic invertebrate community composition, is considered crucial towards influencing and mitigating local/regional development.

Since 1935, the federal navigation channel at Ocean City, MD has disrupted the natural sediment supply to Assateague Island, resulting in wholesale physical and biological changes. A comprehensive mitigation program has been developed involving both short term (one-time beach nourishment) and long term components (sediment bypassing). Implementation and management of these programs will require the ability to

continuously evaluate island conditions, (including changes in the distribution and abundance of rare species), relevant physical processes, and the effects of restoration actions in order to optimize outcomes and ensure maximum compatibility with management objectives.

Portions of ASIS provide suitable habitat for a variety of state and federally listed species, both plants and animals. The known and perceived threats to these species vary in intensity, and include a range of causative factors such as; recreational activities, disruptions to natural coastal processes, and interactions with both native and non-native species. Certain high-profile species such as the piping plover are being actively managed, but others remain poorly understood and are largely ignored. In particular, rare resident plant and insect species, and transient bird species lack appropriate levels of documentation (presence/absence, distribution and abundance), threat mitigation, and assessment.

Non-native plant (especially *Phragmites* and Asiatic sand sedge) and animal species (feral horses, sika deer, nutria) present on Assateague Island are known to be having a significant impact on several of the primary vegetation communities occurring within the park. Documented effects include reduced health and reproductive capacity of certain key plant species, changes in species abundance and community composition, and loss of faunal biodiversity. The development of long-term management programs to mitigate the impacts of these species requires a variety of basic life history, distribution, and relative abundance data to guide decision-making and program implementation/evaluation. The following list include some of Assateague's current natural resource management issues.

- **Estuarine Water Quality** and its affect on the distribution and abundance of submerged aquatic vegetation (SAV's).
- **Altered coastal processes** and its affects on early successional, disturbance-driven beach habitat, and associated plant/animals.
- **Exotic Species** and their impacts on native species and rare/sensitive habitats
- **Recreational Activities** and their impacts on migratory shorebirds using ocean beach as "stopover habitat" as well as the ocean nearshore benthic macroinvertebrate community.
- **Adjacent land use changes** and associated water quality issues.

Cape Cod National Seashore (CACO)

Cape Cod National Seashore preserves approximately 17,442 hectares of uplands, wetlands and tidal lands located on Outer Cape Cod, Massachusetts. A mosaic of natural and cultural resources, which are the result of dynamic natural processes and at least 9,000 years of human activity, characterizes CACO (figure 2).

The natural terrain contains an exceptional array of coastal communities, including pitch pine/oak forest, heathlands (nearly the entire eastern U.S. distribution of heathlands is restricted to fragments on the Outer Cape and in coastal Maine), dunes and coastal plain pond shores. There is also a wide diversity of aquatic and marine habitats, such as kettle ponds, cedar swamps, vernal pools), drowned river valley salt marshes, back barrier salt marshes, barrier spits and inter-tidal mudflats. These habitats support numerous state, federal, and globally rare, threatened, and endangered species of plants, invertebrates, and vertebrates. For many, CACO provides some of the best quality remaining habitat and offers prime opportunities for their preservation regionally. The great Outer Beach also provides outstanding examples of dynamic geomorphic processes.

During the past three centuries Cape Cod ecosystems have been profoundly altered by human occupation. For example, construction of dikes and roadways in estuaries has changed natural tidal regimes and resulted in degradation of water quality and loss of native plant and animal species. Beach and dune stabilization efforts have interfered with natural morphological processes on shorelines. Discharges from nonpoint sources of pollution such as landfills, septic systems, and golf courses have adversely affected surface and groundwater quality. Fire suppression has altered the distribution and volume of the heathland and pitch pine communities that predominated before European settlement. Some of the highest ozone levels in the northeast have been recorded at CACO. Municipal and private in-holdings and over 5 million visitors annually create a formidable challenge to protection and management of natural resources.

Over 800 species of plants are extant in CACO in a wide range of community types including heathlands, fresh and salt water wetlands, tidal marshes, upland forests, beaches, dunes and grasslands. CACO's natural resource management program faces a number of increasingly complex and challenging issues. The following is a list of some of CACO's top management issues.

Cape Cod National Seashore Natural Resource Management Issues.

- **Aquatic/Estuarine Issues** include: cultural nutrient enrichment of Kettle Ponds and Salt Marsh, Historic Diking of Salt Marshes and need for restoration, Mosquitoes and Political Pressure for Mosquito Management, Groundwater Withdrawal and impacts to wetland vegetation and animal life, recreational trampling of kettle pond, shoreline vegetation, Horseshoe Crab Harvesting
- **Development Associated Issues** include: Residential Development within and especially immediately adjacent to the park, leading to: Habitat Fragmentation and increases in road kills, increased pet predation on native wildlife, groundwater withdrawal and septic inputs, increased levels of human activity/disturbance within the park.
- **Landscape/Vegetation Issues** include: Landscape significantly altered by Europeans over nearly 4 centuries. Much of vegetation is a post-agrarian mix of native and alien species, Alien species dominate in many places, Even in native dominated vegetation, community structure does not represent natural condition, Fire suppression impacts,

Loss of grassland/heathland habitats-determining relative amounts that were natural versus anthropogenic.

- **Recreational Impacts include:** Numerous social trails/trampling of vegetation/mountain bike trails, Jet Skis, Pets off leash/hunting dogs, releasing non-native pheasants for put/take hunting, trampling of dune vegetation.
- **Preservation of Native Species Biodiversity include:** Determining extent to which all of the issues listed above contribute to this issue, except for federal listed species, status and distribution of most state-listed species is unknown, out of date, incomplete. Many other species of formerly common species appear to be declining. Data on their status and distribution are lacking. Others appear to have disappeared in recent years. Loss of heathland grassland habitat and declines in associated wildlife species.
- **Shoreline Dynamics include:** Accelerated rates of erosion due to recreational impacts dredging/deposition of spoil

Colonial National Historical Park (COLO)

Colonial National Historical Park's 3,740 hectares are within the coastal plain of Tidewater Virginia (Figure 3). The park consists of two significant land holdings, the Yorktown and Jamestown units, connected by a narrow traffic corridor, called the Colonial Parkway. The park is located adjacent to a rapidly developing urban/suburban area. The entire park has a direct hydrological link to the Chesapeake Bay. Most of the park extends along either the York or James Rivers, two of the largest rivers contiguous to the western shore of the Chesapeake Bay. In addition, numerous streams, creeks and ponds flow through the park and feed directly into one of these two rivers. Mixed pine and hardwood forests cover most of the park. Substantial acreage of both tidal and nontidal wetlands and open fields also exist. The park is within the boundaries of the counties of York, James City, Gloucester, Surry, the City of Williamsburg and Virginia Beach.

More than 30 miles of shoreline along the James and York rivers bounds the park. In addition, approximately 24 miles of perennial streams and 30 miles of intermittent streams and drainage's flow through the park. Numerous freshwater tributaries in Yorktown become tidally influenced estuarine waters as they approach the James and York rivers. The Colonial Parkway passes among upland and tidal streams as well as freshwater and brackish ponds. A freshwater spring and a small creek are found at Green Spring plantation and a series of springs and seeps originate on Yorktown Battlefield. Numerous ephemeral sinkholes occur in the Yorktown Battlefield and along the Parkway between Yorktown and College Creek. Preliminary findings indicate generally good water quality in most surface waters within the park. However, some streams are impaired based on analysis of physical attributes and benthos. Most of the water bodies and wetlands in the park have major portions of their drainage basin upstream and outside

of park boundaries. Therefore, activities outside of the park have a detrimental effect on water quality within the park (oil spills, erosion and sedimentation, chemicals).

Erosion is a significant process along the river shorelines of the park. Although much of the erosion results from normal and storm induced wave activity, impacts resulting from recreational use have become a concern. Shoreline recession threatens the cultural resources of Jamestown Island, Glasshouse Point and Yorktown. The park in cooperation with the Virginia Institute of Marine Science and the US Army Corp of Engineers conducted a study of the 17 miles of park shoreline along the James River. The study has provided a better understanding of the shoreline erosion process over the past decades, those areas experiencing the highest erosion rates and recommendations (with alternatives) for conserving the shoreline and its associated cultural and natural resources. A cost benefit analysis has been completed and approved. Major funding has been procured and an EIS is being prepared.

The park, in cooperation with researchers from the Virginia Institute of Marine Science conducted a study to investigate the effects of adjacent urban and agricultural development on the shallow groundwater and selected surface water resources of the park. Testing indicates potential local sources of groundwater contamination from nitrate and ammonia at several sites near Jamestown Island, Williamsburg and Yorktown. Salinity and phosphate concentrations were low or below detectable levels. The US Geological Survey, USGS is conducting a study to develop the hydrogeological framework of the Yorktown area of the park and surrounding environs.

The biological resources of Colonial NHP include a variety of birds, fish, mammals, aquatic invertebrates, plants and wetlands typical of the mid-Atlantic Coastal Plain. None of these resources is limited to the park, but parklands provide important habitat within the larger geographic area. The park contains significant aquatic habitats within the tidal systems found along the shores of the York and James rivers and in most of the tidal creeks to those rivers. In addition, freshwater streams and ponds in the Yorktown unit and along the Colonial Parkway support a number of freshwater aquatic communities. Protection of these aquatic communities is also important because the park provides unique opportunities for public observation, education and recreational fishing. The roadways and access areas throughout the park afford opportunities for close examination of wetlands and waterfowl as well as opportunities for swimming fishing and shellfishing.

According to studies by the Virginia Department of Conservation and Recreation, Division of Natural Heritage Colonial NHP has the second highest number of rare threatened and endangered species of all the National Park Service units in the state. The inventory reports indicate the importance of parklands and areas adjacent to the park. The Division of Natural Heritage has recently completed a detailed management plan for these species and habitats. The following is a list of current park management issues faced at the park:

- **Shoreline Change:** River shoreline erosion along the shorelines of COLO is significant. It is caused by normal and storm induced wave activity and visitor recreational use. Recent research has provided a better understanding of the shoreline erosion process, those areas experiencing the highest erosion rates and recommendations for conserving the shoreline and its associated cultural and natural resources.
- **Estuarine water quality-**Loss of submerged aquatic vegetation (SAV's) within estuarine habitats at COLO has been noted. Current estuarine water quality within this area is unknown.
- **Aquatic impacts from adjacent land use:** COLO is located adjacent to a rapidly developing urban/suburban area. The entire park has a direct hydrological link to the Chesapeake Bay. Numerous streams, creeks and ponds with major portions of their drainage basin upstream and outside of park boundaries, flow through the park and feed directly into the York or James River. Preliminary analysis of physical attributes and benthos in some of these streams indicate that they are impaired. Activities from adjacent urban and agricultural development may have a detrimental effect on water quality within the park.
- **Groundwater contamination:** Testing indicates potential local sources of groundwater contamination from nitrate and ammonia at several sites near Jamestown Island, Williamsburg and Yorktown. The US Geological Survey, USGS is conducting a study to develop the hydrogeological framework of the Yorktown area of the park and surrounding environs.
- **Visitor and recreational use impacts/Endangered species protection-**COLO has the second highest number of rare, threatened and endangered species of all the National Park Service units in the state. Visitor impacts and recreational activity effects on rare, threatened and endangered species and other species is unknown
- **Exotic species management-**Currently the impacts of exotic species on native species and rare/sensitive habitats is unknown.

Fire Island National Seashore (FIIS)

Fire Island is a barrier island located along the southern coast of Long Island, New York. Approximately 51 km long and averaging about 0.5 km in width, the island is bordered by the inlets of Fire Island to the west and Moriches to the east and is separated from Long Island by the Great South and Moriches Bays. Under Public Law 88-587, Fire Island National Seashore (FIIS) was established on September 11, 1964, “for the purpose of conserving and preserving for the use of future generations relatively unspoiled and undeveloped beaches, dunes and other natural features...” (NPS 1999). The Fire Island National Seashore consists of 42 km of Fire Island itself (Figure 4). The Seashore is

7,832 hectares, not including Smith Point County Park located at the eastern end within the boundaries of the National Seashore. Approximately 4,300 hectares of the Park are submerged in the Great South Bay or Atlantic Ocean. The Smith Point County Park (from Smith Point West to Moriches Inlet) falls within the boundary of the National Seashore but is administered by the Suffolk County Park Commission. Robert Moses State Park, on the western end of Fire Island, is not within the authorized boundary of FIIS and is managed by the Long Island State Park Regional authorities.

Natural resource management at FIIS deals with extremes in land use issues within the park. The only federally designated wilderness in the state of New York and in National Parks of the Northeastern United States is found on eastern Fire Island, between Smith Point and Watch Hill. On the hand, seventeen private resort communities comprising approximately 4,000 homes, lie within the administrative boundary of FIIS on the western end of the island. The presence of these communities complicates management in the park. These communities are accessed either by boat across the Great South Bay or by vehicle via the Robert Moses Causeway. Annual visitation to the National Seashore exceeds 1 million.

The physiognomy of Fire Island is typical of Atlantic barrier islands that grade from a primary dune along the ocean to salt marsh along the bay. The dominant vegetation includes pitch pine (*Pinus rigida*), beach grass (*Ammophila breviligulata*), wax myrtle (*Myrica cerifera*), bayberry (*M. pensylvanica*), shadbush (*Amelanchier canadensis*), and common greenbrier (*Smilax rotundifolia*). This particular composition of vegetation is typical of the island except within the various communities where residents have planted non-indigenous vegetation.

The percentages of terrestrial habitats found at FIIS include: 10% forested and 40% wetlands, 25% open (beach, swale and fields), 25% developed either by NPS or the 17 local communities on the island. Of the submerged portion, 80% is in Great South Bay and 20% is the Atlantic Ocean. All existing habitats within FIIS are listed as threatened. Unique Resources include the Sunken Forest that is a maritime Holly Forest; a Federal Wilderness Area (520 hectares); and eel grass beds. The Sunken Forest on Fire Island is a 16 hectare maritime oak-holly forest occurring behind the secondary dune, one of only a few mature maritime forests in the New York area and the northernmost holly-dominated maritime forest on the Atlantic barrier island chain. The Nature Conservancy lists this community type as globally imperiled (G2). Both Federal and NYS Endangered species either breed or germinate in the park, as well as eleven species of concern..

The William Floyd Estate (FIIS-WFE), located across Great South Bay on Long Island mainland, is quite different from FIIS's barrier island habitat. The William Floyd Estate is 65% forested, 25% wetlands including salt marsh, 5% open space and 5% developed around the estate house area. Species found at FIIS-WFE include great blue herons, great and snowy egrets, willets, and diamond-backed terrapins.

Some of FIIS' natural resource management issues include:

- **Threatened/Endangered Species and Rare Species Management-** There is a need for more extensive research and species zone delineation to protect R, T and E animals and plants and a need for direct habitat restoration activities. Issues include prevention of recreational stress on vegetation species, many species of which are

threatened or endangered and monitoring disturbance of endangered and threatened vegetation.

- **Wildlife and habitat health**- Re-inventorying FIIS fauna to update and identify distribution and impact type issues is needed. Other issues include managing deer overpopulation due to recreational feeding of deer; preventing the spread of Lyme disease to visitors; preventing over browsing of vegetation by deer; maintaining good water quality for finfish and shellfish nursery habitat. Also, recreational and commercial fishing survey is needed to determine impacts on the finfish population.
- **Aquatic Resources**-The chemical and biological condition of FIIS salt water estuaries is unknown. State Fisheries data indicate finfish and shellfish populations are stressed due to pollution and degradation of habitat near FIIS. Identifying impacts to aquatic resources possibly due to channel and marina dredging and pollution from community marinas is needed.
- **Air Resources**-There is a general lack of knowledge regarding air quality on FIIS; Monitoring is needed.
- **Recreation and Visitor Use impacts**-Issues include preventing primary dune vegetation loss due to pedestrian and vehicle disturbance; controlling the extent of human disturbance on plant species in sensitive areas such as The Wilderness Area and the Sunken Forest and controlling the use of personal watercraft due to aesthetic impacts.
- **Impacts to Aesthetic Resources**-Aesthetic concerns include structures, bulkheads, groins, beach scraping and barrier island uses
- **Lateral sand transport**-Bottom dredging of the marina channels disrupts bayside lateral sand transport. The groins on the Ocean Beach impact lateral sand transport on the ocean side. Extensive study of sand transport on FIIS is needed.
- **Mosquito management**-The extent of public threat due to Eastern Equine Encephalitis at areas on FIIS is being investigated and there is a need to determine the applicability of Open water Marsh Management to decrease mosquito populations.
- **Adjacent land use**-Determining impacts of water quality due to heavily populated region
- **Exotic species management**-The dominance of exotic species on Fire Island is not being studied sufficiently. Preliminary studies suggest exotics plant in the private communities on FIIS may be encroaching onto federal lands (i.e. bamboo). Also phragmites continues to increase in the marsh areas if the Wilderness.
- **Shoreline change**-There is a need to continue to monitor shoreline change to determine the extent of change seasonally and after unusually strong storms

Saltmarsh restoration-Monitoring and research is required to determine the if passive restoration is the best action at this time.

Gateway National Recreation Area (GATE)

Gateway is 10,644 hectares of coastal uplands, freshwater ponds, marshes, bays and mudflats. Established in 1972, it is divided into three geographically separate units that constitute some of the largest and most significant natural areas remaining in the metropolitan New York City area (Figure 5). They include the Jamaica Bay/Breezy Point Unit (Riis Park, Fort Tilden, Breezy Point Tip, Floyd Bennett Field, Plumb Beach, North shore of Jamaica Bay and the 3,662 hectare Jamaica Bay Wildlife Refuge); the Staten Island Unit (Great Kills Park and Miller Field) and the Sandy Hook Unit.

Jamaica Bay/Breezy Point Unit-The Jamaica Bay habitat complex is located on the southwestern tip of Long Island in the boroughs of Brooklyn and Queens, New York City and the town of Hempstead, Nassau County. The bay connects with Lower New York Bay to the west through Rockaway Inlet and is the westernmost of the coastal lagoons on the south shore of Long Island. Breezy Point is the western tip of the Rockaway barrier beach to the south of Jamaica Bay and Rockaway Inlet. This habitat complex includes the entire Jamaica Bay estuarine lagoon, part of Rockaway Inlet, and the western part of the Rockaway barrier beach. The boundary of this area generally follows the shoreline of Jamaica Bay and includes most of the tidal creeks and undeveloped upland areas adjacent to the bay; these serve as buffers for the bay, as upland habitat, and as existing and potential restoration sites. This complex also contains the western end of the Rockaway barrier beach and the Marine Park/Plumb Beach area just to the west of the main body of Jamaica Bay to include beach and dune habitat for nesting bird and rare plant species. The bay proper and portions of Rockaway Inlet encompass important breeding and juvenile nursery habitat for fisheries as well as year-round foraging areas for waterfowl, shorebirds, and colonial nesting waterbirds. The extensive salt marsh and upland islands in the bay provide nesting habitat for gulls, terns, waterfowl, and herons; foraging and roosting habitat for shorebirds and waterbirds; upland sites for grassland bird nesting and foraging areas; and butterfly concentration areas. Despite the surrounding intensive residential, commercial, and industrial development, Jamaica Bay and Breezy Point continue to be incredibly valuable for resident and migratory fish and birds and for other wildlife and plant populations.

Jamaica Bay has been designated and mapped as an otherwise protected beach unit pursuant to the federal Coastal Barrier Resources Act, prohibiting incompatible federal financial assistance or flood insurance within the unit. The New York State Natural Heritage Program, in conjunction with The Nature Conservancy, recognizes Breezy Point as a Priority Site for Biodiversity (B2 - very high biodiversity significance). Jamaica Bay and Breezy Point have been designated as Significant Coastal Fish and Wildlife Habitats by the New York State Department of State, and the bay up to the high tide line was designated as a Critical Environmental Area by the New York State Department of Environmental Conservation. Jamaica Bay was also designated as one of three special natural waterfront areas by New York City's Department of City Planning.

Jamaica Bay is a saline to brackish, eutrophic (nutrient-rich) estuary covering about 10,118 hectares (25,000 acres), with a mean depth of 4 meters (13 feet), a semidiurnal tidal range averaging 1.5 meters (5 feet), and a residence time of about 33 days. The bay communicates with Lower New York Bay and the Atlantic Ocean via Rockaway Inlet, a high current area that is one kilometer (0.63 mile) wide at its narrowest point, with an average depth of 7 meters (23 feet). Measurements taken during recent surveys in Jamaica Bay indicate average yearly ranges for temperature of 1 to 26°C (34 to 79°F), salinity of 20.5 to 26 parts per thousand, dissolved oxygen of 3.5 to 18.5 milligrams/liter, and pH of 6.8 to 9. Loadings of nutrients and organic matter into the bay from sewage treatment plants and runoff result in phytoplankton blooms and high suspended solid concentrations which, in turn, result in turbid water and low bottom dissolved oxygen concentrations. Jamaica Bay is in the middle of the New York City metropolitan area and the uplands around the bay, as well as much of the Rockaway barrier beach, are dominated by urban, residential, commercial, and industrial development. The bay itself has been disturbed by dredging, filling, and development, including the construction of Floyd Bennett Field and John F. Kennedy Airport. About 4,856 of the original 6,475 hectares (12,000 of the original 16,000 acres) of wetlands in the bay have been filled in, mostly around the perimeter of the bay. Extensive areas of the bay have been dredged for navigation channels and to provide fill for the airports and other construction projects. The center of the bay is dominated by subtidal open water and extensive low-lying islands with areas of salt marsh, intertidal flats, and uplands important for colonial nesting waterbirds. The average mean low tide exposes 142 hectares (350 acres) of mudflat, 375 hectares (925 acres) of low salt marsh dominated by low marsh cordgrass (*Spartina alterniflora*), and 213 hectares (526 acres) of high marsh dominated by high marsh cordgrass (*Spartina patens*). The extensive intertidal areas are rich in food resources, including a variety of benthic invertebrates and macroalgae dominated by sea lettuce (*Ulva latuca*). These rich food resources attract a variety of fish, shorebirds, and waterfowl. This area is largely separated from disturbance and predation occurring on the surrounding mainland, and support large numbers of nesting waterbirds and diverse migratory birds throughout the year. At least 326 species of birds have been sighted in the Refuge, including confirmed breeding by 62 species.

Breezy Point contains an approximately 81-hectare natural area at the western tip of the Rockaway Peninsula with an accreting wide ocean beach, beachgrass dunes, grassland/shrub thicket, and fringing salt marshes on the bay side. A stone jetty extends out from the tip of Breezy Point. East of this natural area, the barrier behind the beach front has been largely developed into residential, commercial, and recreational areas. Floyd Bennett Field is a 579 hectare historic civic aviation facility dominated by human-made structures and runways but with extensive areas of open space between the runways. It includes a 57 hectare grassland area restored and maintained by the National Park Service and New York City Audubon Society as the Grassland Restoration and Management Project. There are smaller areas of shrub thicket dominated by bayberry, winged sumac (*Rhus copallina*), and Japanese knotweed (*Polygonum cuspidatum*) as well as developing woodland consisting of black cherry, grey birch (*Betula populifolia*), and cottonwood (*Populus deltoides*). Common reed (*Phragmites australis*) marsh and small areas of low marsh and mudflat along the shoreline of the bay exist as well.

The location of Jamaica Bay and Breezy Point and the rich food resources found there make it a regionally important fish, wildlife, and plant habitat complex. Jamaica Bay is located adjacent to the confluence of the New York Bight and New York Bay, and is at the turning point of the primarily east-west oriented coastline of New England and Long Island and the north-south oriented coastline of the mid-Atlantic coast. This geographic location acts to concentrate marine and estuarine species migrating between the New York Bight portion of the North Atlantic and the Hudson-Raritan Estuary. Shorebirds, raptors, waterfowl, landbirds, and various migratory insects are concentrated by the coastlines in both directions. These migratory species are further concentrated by the surrounding urban developed land into the remaining open space and open water of Jamaica Bay. Jamaica Bay and Breezy Point support seasonal or year-round populations of 214 species of special emphasis and listed species, incorporating 48 species of fish and 120 species of birds, and including the following federally listed and state-listed species.

Staten Island Unit -The Great Kills Harbor and Park include large areas of disturbed common reed marsh with grassland and shrub thicket at Crookes Point. The outer shoreline follows a narrow, sandy, groined beach. A large area of flats in Great Kills Harbor extends southwest along the Staten Island Shoreline as far as Wolfe's Pond. The significance of this complex relates to its geographic location and to the variety and quality of habitat types found here; these include shallow estuarine open waters, sandy beach, maritime forest, salt marsh, mudflats, and riparian forest. These habitats support a large number of regionally rare and important species. Due to its complex geology and glacial history, Staten Island supports an unusual diversity of habitat types and rare plant species.

Sandy Hook Unit- Sandy Hook is the only undeveloped barrier beach area on the northern end of the New Jersey coastline north of Island Beach State Park, located 55 kilometers (34 miles) to the south. Its sandy shorelines and backdunes provide germination and breeding habitats for a variety of threatened, endangered and rare species of flora and fauna. Maritime holly forests that occur at Sandy Hook occur at only a few other locations in the region and are a globally imperiled community due to their rarity. The forests are important as roosting and nesting locations for a variety of birds, and include historical nesting by great blue heron, historical nesting and present roosting by black-crowned night-heron (*Nycticorax nycticorax*), and nesting by several pairs of osprey and several species of passerines. The holly is also a host plant for the regionally rare butterfly Henry's Elfin (*Incisalia henrici*)

Raritan and Sandy Hook Bays form the southeastern portion of the New York - New Jersey Harbor between the southern shoreline of Staten Island, Richmond County, New York, and the northern shoreline of Monmouth County, New Jersey. Raritan Bay - Sandy Hook Bay is a large embayment measuring nine by twelve miles (109 square miles) with a surface area of about 28,000 hectares (69,188 acres). The inshore portion of the bays within this habitat complex has a total area of 13,500 hectares (33,500 acres). The wetlands, uplands, and nearshore waters form a bayshore complex which is critical for migratory and resident birds and fish. Raritan and Sandy Hook Bays are divided between the states of New Jersey and New York, and receive direct inflow from the Raritan River, the Shrewsbury and Navesink Rivers, and numerous smaller tributaries along the shorelines of Staten Island and New Jersey. The bay is relatively shallow,

usually less than 6 meters (20 feet) in depth except for dredged channels which range in width from 24 to 427 meters (80 to 1400 feet) and are 3 to 11 meters (10 to 35 feet) in depth. The tidal range averages 1.7 meters (5.5 feet). Compared with other parts of the New York - New Jersey Harbor Estuary, the shorelines of Raritan and Sandy Hook Bays have more remaining natural shoreline and open space. The area is subject to a wide variety of fluctuations in temperature, salinity, and dissolved oxygen, both from natural and anthropogenic activity, especially industrial and sewage effluent and storm-water runoff.

The Sandy Hook Peninsula separates the Atlantic Ocean from the southern portion of the New York - New Jersey Harbor Estuary and serves as a dividing line between certain groups of species, with marine, estuarine, and anadromous species concentrated on the outside, shorebirds and waterfowl concentrated on the inside, and migratory landbirds (raptors and passerines) concentrated on the peninsula itself. As is true with Jamaica Bay and Breezy Point on the other side of the Harbor entrance, Sandy Hook and Sandy Hook Bay are at the turning point of the primarily east-west oriented coastline of New England and Long Island and the north-south oriented coastline of the mid-Atlantic coast. This geographic location and configuration acts to concentrate marine and estuarine species migrating between the New York Bight portion of the North Atlantic and the Hudson-Raritan Estuary. Also, shorebirds, raptors, waterfowl, landbirds, and a variety of migratory insects migrating in both directions are concentrated in the Harbor by these coastlines. These migratory species are further forced by the surrounding urban developed land into the remaining open space and open water of Raritan and Sandy Hook bays and surrounding coastlands. There are 205 species of special emphasis regularly using the waters and shorelands of Raritan Bay and Sandy Hook.

Gateway National Recreation Area natural resource management issues include:

- **Urban/Development Associated Impacts:** Jamaica Bay is in the middle of the New York City metropolitan area and the uplands around the bay, as well as much of the Rockaway barrier beach, are dominated by urban, residential, commercial, and industrial development. Consequently, issues such as habitat fragmentation, increases in road kills, increased pet predation on native wildlife and increased levels of human activity/disturbance within the park must be considered.
- **Adjacent land uses that impact on aquatic systems-** Loadings of nutrients and organic matter into Jamaica Bay from sewage treatment plants and runoff result in phytoplankton blooms and high suspended solid concentrations which, in turn, result in turbid water and low bottom dissolved oxygen concentrations. At Sandy Hook, the surrounding waters are subject to a wide variety of fluctuations in temperature, salinity, and dissolved oxygen, both from natural and anthropogenic activity, especially industrial and sewage effluent and storm-water runoff.
- **Loss of Marsh habitat/islands in Jamaica Bay-**The bay has been disturbed by dredging, filling, and development, including the construction of Floyd Bennett Field and John F. Kennedy Airport. About 4,856 of the original 6,475 hectares (12,000 of the original 16,000 acres) of wetlands in the bay have been filled in, mostly around

the perimeter of the bay. Extensive areas of the bay have been dredged for navigation channels and to provide fill for the airports and other construction projects. Current scientific research shows Jamaica Bay losing a significant amount of marsh habitats and islands annually. Jamaica Bay and its associated marsh habitats are noted as critical for several species of breeding birds and fish as well as for growth and development of birds, fish, diamondback terrapins and some sea turtles.

- **Wildlife Management Issues include:** Aircraft collision with birds originating in GATE; Neotropical migrants use of park habitats; Other wildlife species that have the potential to impact on piping plover (federally listed species) and other beach nesting birds such as roseate tern, American oystercatcher and black skimmer (all state listed species); potential rabies vectors such as raccoons;

George Washington Birthplace National Monument (GEWA)

George Washington Birthplace National Monument is located on the northern neck of rural and tidal Virginia about 56 kilometers east of Fredericksburg on highway 3 and about 97 km south of Washington, D.C. in Westmoreland Co. (Figure 6). The park consists of 220 hectares along the tidal reaches of the Potomac River. The park is fairly flat, typical of the coastal plain. Bounded by the Potomac on the north, the western edge of the park includes Bridges Creek, marsh and private lands, with the southern portion bounded by Pope's Creek estuary and private land, Pope's Creek is found to the east. GEWA lies within the Potomac River watershed, and the greater Chesapeake Bay watershed. Three small sub-basins drain into the Potomac at GEWA. These are Pope's Creek, Bridges Creek, and a third unnamed creek. Land-use in these three sub-basins is largely agricultural. Salinity of Pope's Creek and other marshes within the park can be as much as 60‰ sea water with crabs, jellyfish, oysters and other marine organisms present. Erosion along the Potomac shoreline is severe and represents significant threats to the park. Primary habitats include about 100 ha of mixed conifer/hardwood forest and loblolly plantations, 90 ha of open fields, 60 ha of fresh and saltwater marshes and swamps, and 7 ha of developed and historic areas. Three freshwater ponds and about 2000 meters of Potomac beach and cliffs are also present.

George Washington Birthplace National Monument natural resource management issues include:

- **Shoreline Change:** Erosion along the Potomac shoreline is severe and represents significant threats to estuarine water quality, salt marsh health and biotic diversity. Documentation of the impacts from erosion at GEWA including loss of plant species is needed to provide a better understanding of the shoreline erosion process, those areas within GEWA experiencing the highest erosion rates and recommendations for conserving the shoreline and its associated cultural and natural resources.
- **Water quality-**Extensive testing or documentation of freshwater and estuarine water quality is required to determine potential contaminant impacts to aquatic habitat

health at GEWA. This work is essential in order to begin the process of possibly restoring Pope's Creek as a spawning area for species such as oysters and sturgeon

- **Wildlife Management-** Issues include protection of rare, threatened and endangered wildlife species; appropriate deer and woodchuck population management
- **Habitat management-** Issues include documentation of habitat health within forested and marsh areas; native warm-season and meadow grass species re-introduction; protection of rare, threatened and endangered vegetative species
- **Exotic species management-**Currently the impacts of exotic species on native species and rare/sensitive habitats is unknown.

Thomas Stone National Historic Site (THST)

Thomas Stone National Historic Site is located about 32 km south of Washington D.C (no map digital map available). The site is comprised of 130 hectares of hilly lands that drain into the Hoghole Run, emptying into the Port Tobacco Creek about 1.75km south of the park boundary. Relief of the landscape is approximately 35 meters with three main drainages and numerous springs and seeps. About 100 ha are mixed forests, 20 ha fields, and 2 ha of developed area.

No biological inventories have been done at THST so there has been a large gap in knowledge about the existing natural resources found there. Over the past couple of years due to the Natural Resource Challenge, implementation of vertebrate and vascular plant inventories has begun in the park. In 2001, a vegetation classification and mapping project was initiated at THST, The principal investigator for the vegetation classification portion of this project, found and collected a sedge species of the genus *Carex* that did not match known species for the state, even following comparisons with specimens in herbaria. The specimen was forwarded to Dr. Tony Reznicek (University of Michigan and a Flora of North America (FNA) author for the genus), who recognized it as a species that was undescribed but the subject of a taxonomic paper in progress by two colleagues. Dr. Reznicek delivered the specimen to one of the authors, Dr. Rob Naczi (Delaware State University and another FNA author), who confirmed its identity. Dr. Naczi and his co-author, Dr. Charles Bryson, plan to cite the Thomas Stone NHS specimen as a paratype in their paper, which is expected to be published in early 2002 and will formally describe and name this species. (Paratypes are specimens examined by a species author that are supplemental to the holotype ("type specimen") and are often listed in a formal description as representations of a new species across its range and its habitat breadth). Thus, the sedge found at Thomas Stone NHS will contribute to the description of a species new to science and also represent the first known Maryland occurrence of it.

Small parks like THST with cultural themes are often easily dismissed as unlikely reservoirs of biodiversity, let alone sites of new taxonomic discoveries. As inventories on birds, mammals and herps progress in the park, along with the better understanding of the

existing biodiversity, natural resource management issues at THST will most likely be evolving as more information becomes available.

Thomas Stone National Historic Site natural resource management issues include:

- **Wildlife Management-** Issues include a need for documentation of wildlife species composition, distribution and abundance and habitat use; need for documentation of rare, threatened, endangered and exotic wildlife species; determining effects of hunting and power line rights of way on species; deer browse monitoring
- **Habitat management-** Issues include a need for documentation of park vegetation species composition, distribution and abundance; a need for documentation of rare, threatened, endangered, exotic and invasive vegetative species; a need for documentation of habitat health within forested and riparian areas; determining effects of power line rights of way on species; native warm-season and meadow grass species re-introduction.

Sagamore Hill National Historic Site (SAHI)

Sagamore Hill National Historic Site is the home of Theodore Roosevelt located on the peninsula of Cove Neck, Long Island, New York (Figure 7). In 1883 Roosevelt purchased farmland with shoreline on both Oyster Bay and Cold Spring Harbor. He quickly sold off some of the property facing Oyster Bay to relatives, and built a large country home on the top of a hill with views across the water. Farm fields gave way to an oak-chestnut-tulip forest running down to a salt marsh that opens to Cold Spring Harbor. His family eventually sold off more acreage until it reached its current size of 35 hectares.

Today the farm has given way to visitor facilities including a parking lot and visitor center (0.8 hectares combined), paved driveways, and mowed lawns (4 hectares). There remains about 4.8 hectares of rough fields. The forest of about 20 hectares has matured despite the loss of the chestnuts to the blight. The easternmost forested and saltmarsh area of the park were declared a "Natural Environmental Study Area" by Congress in the early 1970's. The 4 hectare Eel Creek saltmarsh is an excellent example of the tidal saltmarshes that once lined the shore of Long Island.

Sagamore Hill National Historic Site natural resource management issues include:

- **Wildlife Management-** Issues include a need for documentation of wildlife species composition, distribution and abundance and habitat use; need for documentation of rare, threatened, endangered and exotic wildlife species.
- **Habitat management-** Issues include a need for management recommendations regarding park habitats based on previous documentation and current field work